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CO₂ LASER FREQUENCY MULTIPLICATION
REPORT FOR MARCH 1992

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The duration of the mode-locked CO₂ laser pulses was measured to be 0.9 ± 0.1 nsec by the technique of (second harmonic) autocorrelation. Knowing the pulse duration, the spot size, and the harmonic conversion efficiency, a detailed fit of experiment to theory gave an estimate of the nonlinear coefficient of AgGaSe₂, $d_{36} = 31 \pm 4$ pm V⁻¹, in agreement with the most accurate literature values.

A number of experiments were made with longer pulse trains (3 μ sec) in which the highest harmonic energy conversion reached 78%. The damage threshold was measured and it turned out to be related much more strongly to fluence than intensity. The shorter pulse trains (0.35 μ sec) had peak intensities of close to 300 MW cm⁻² whereas the longer trains (3 μ sec) had intensities up to 40 MW cm⁻². The fluence for surface damage at 9.55 μ m was

$$F_D = 2T^{0.25} \text{ J cm}^{-2}$$

where T is the duration of the pulse train in μ sec. These results are comparable to the damage fluence measured for 20 nsec pulses with smooth envelopes.

The writing of the final report has begun and some estimates are being generated of average-power performance of AgGaSe₂ in frequency multiplication. Further measurements of second harmonic beam quality are in progress, at propagation distances of more than 30 m.

It is anticipated that the experimental program will be complete by mid April and the report will be complete by late April.

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